

BULLETIN

OF THE INSTITUTE OF METALS

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PART 12

INSTITUTE NEWS

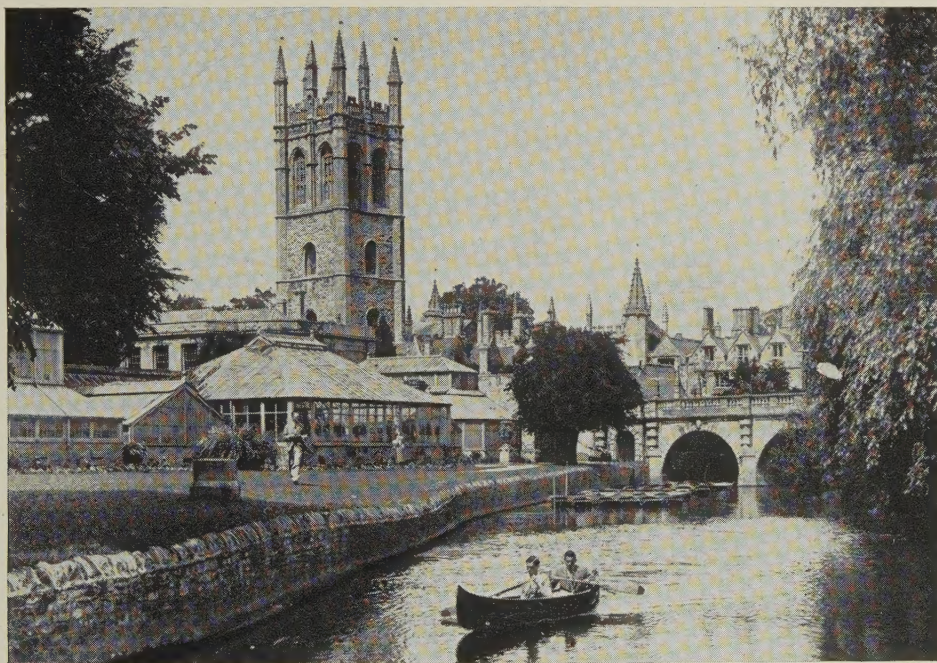
Membership

As the new financial year of the Institute began on 1 July, the present is a particularly good time at which to join the Institute. Members are therefore requested to bring this fact to the notice of any of their friends who may be interested in membership.

Members elected before 15 September will be entitled to participate in the full programme arranged for the Autumn Meeting in Oxford, and will, of course, receive copies of the monthly *Journal* from the issue for July 1952.

Other members may obtain copies on application to the Secretary. A copy of the programme was published in the issue of the *Bulletin* for July, pp. 89-92.

The Council hopes that this meeting will be largely attended by members and that those who will not be accompanied by ladies will apply to the Secretary of the Institute to be allocated accommodation in Magdalen College, where private rooms, common rooms, and a bar have been arranged for members' convenience, by permission of the President of the college. The charge for accommodation, meals, and gratuities is 30s. per day.



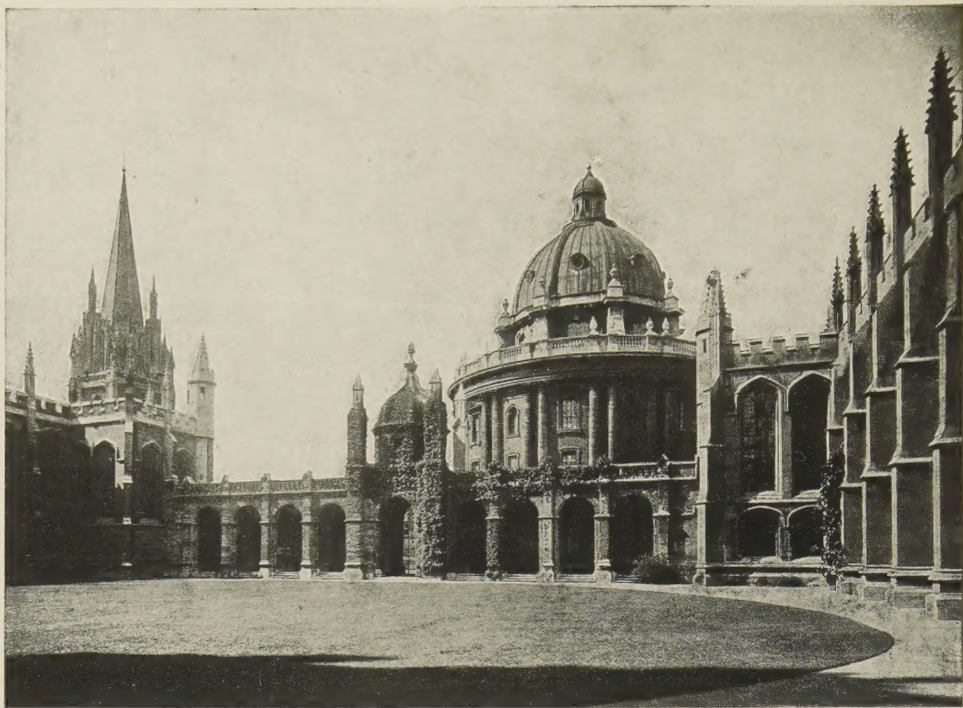
Magdalen College and Bridge, Oxford.

Autumn Meeting in Oxford, September 15-19, 1952

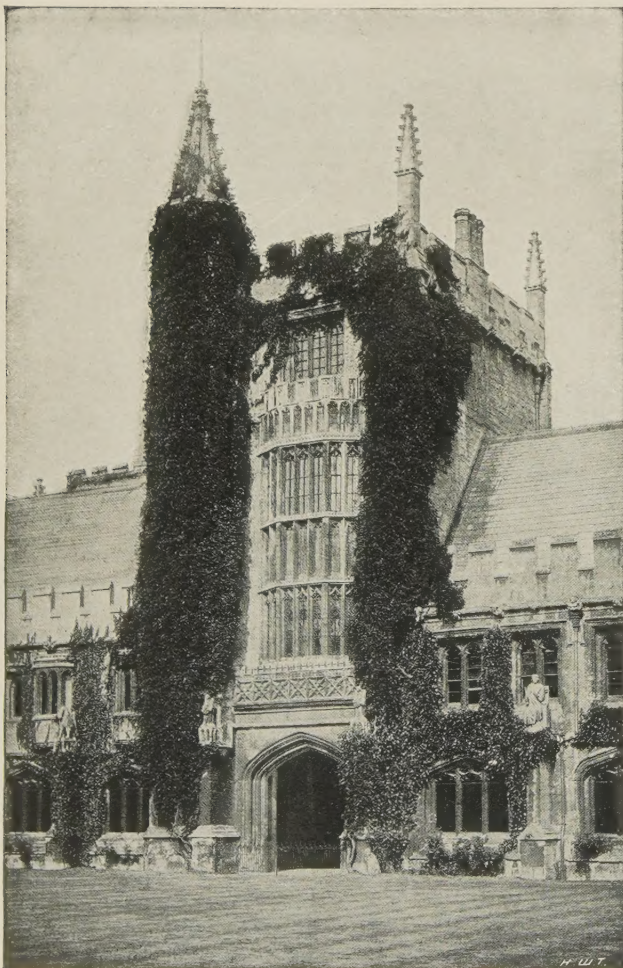
Members resident in Europe should now have received copies of the programme and reply form issued in connection with the Annual Autumn Meeting, which is to be held in Oxford from Monday, 15 September to Friday, 19 September.

Informal Discussion on Grain Boundaries

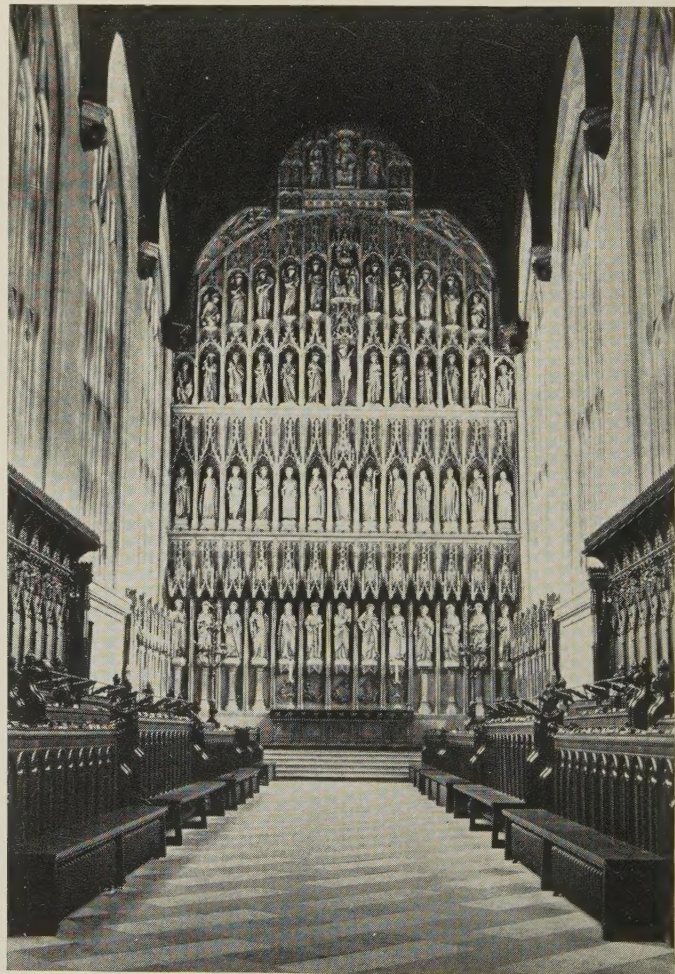
In response to a number of requests for a meeting in the nature of an entirely informal discussion, the Metal Physics Committee is arranging, as an experiment, a discussion on "Grain Boundaries" during the Autumn Meeting at Oxford. The discussion will take place on 18 September at 9.30 a.m.



All Souls College Quadrangle, Oxford, with the Radcliffe Camera and Spire of the Church of St. Mary the Virgin.



Founder's Tower, Magdalen College, Oxford.



New College Chapel, Oxford : The Reredos.

Illustrations by permission of Oxford Publicity Board and Alden and Co., Ltd.

The subject will be introduced briefly by Mr. R. King and Mr. H. W. G. Hignett. Mr. King will outline present views on the nature and behaviour of grain boundaries, and Mr. Hignett will speak on the practical aspects of the subject. The informal nature of the discussion is emphasized; contributions on any topic concerned with grain boundaries will be welcomed.

Symposium on Properties of Metallic Surfaces

An all-day symposium on "Properties of Metallic Surfaces", arranged by the Metal Physics Committee, will be held in the Lecture Theatre of the Royal Institution, Albemarle Street, London, W.1, on Wednesday, 19 November 1952, from 9.45 a.m. to 5.0 p.m.

The papers contributed to the Symposium will be discussed at two sessions, as follows:

Session I. (Morning)

(i) "Specialized Microscopical Techniques in Metallurgy", by Professor S. Tolansky, F.R.S. (Royal Holloway College, University of London).

(ii) "Radioisotopes in the Study of Metal Surface Reactions in Solutions", by Dr. M. T. Simnad (Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa., U.S.A.).

(iii) "The Crystalline Character of Abraded Surfaces", by Dr. P. Gay and Dr. P. B. Hirsch (Cavendish Laboratory, Cambridge).

(iv) "Diffusion Coatings", by Mr. D. M. Dovey, Dr. I. Jenkins, and Mr. K. C. Randle (Research Laboratories, The General Electric Co., Ltd., Wembley).

(v) "The Nature and Properties of the Anodic Film on Aluminium and Its Alloys", by Mr. H. W. L. Phillips (Research Laboratories, The British Aluminium Co., Ltd., Gerrards Cross).

(vi) "Chemical Behaviour as Influenced by Surface Condition", by Dr. U. R. Evans, F.R.S. (Cambridge University).

(vii) "The Effect of Method of Preparation on the High-Frequency Surface Resistance of Metals", by Dr. R. G. Chambers and Dr. A. B. Pippard (Royal Society Mond Laboratory, Cambridge).

Session II. (Afternoon)

(i) "The Influence of Machining and Grinding Methods on the Mechanical and Physical Condition of Metal Surfaces", by Mr. P. Spear, Mr. I. R. Robinson, and Mr. K. J. B. Wolfe (The B.S.A. Group Machinability Laboratory, B.S.A. Tools, Ltd., Birmingham).

(ii) "The Effect of Lubrication and Nature of Superficial Layer After Prolonged Periods of Running", by Dr. F. T. Barwell (Lubrication Division, Mechanical Engineering Research Organization, Thorntonhall, near Glasgow).

(iii) "The Effect of Surface Conditions on the Mechanical Properties of Metals, Mainly Single Crystals", by Professor E. N. da C. Andrade, F.R.S. (The Royal Institution, London).

(iv) "The Effect of Surface Condition on the Strength of Brittle Materials", by Professor C. Gurney (University College, Cardiff).

(v) "The Influence of Surface Condition on the Fatigue Strength of Steel", by Mr. R. J. Love (Motor Industry Research Association, Brentford).

(vi) "The Influence of Surface Films on the Friction and Deformation of Surfaces", by Dr. F. P. Bowden and Dr. D. Tabor (Cambridge University).

A programme and reply form will be circulated to all European members in August; other members may obtain copies on application to the Secretary. Attendance at the meeting will be free to all who are interested in the subject, but non-members of the Institute who wish to receive the papers must apply to the Secretary, The Institute of Metals, 4 Grosvenor Gardens, London, S.W.1, for a registration form.

To stimulate discussion, advance copies of the papers will be supplied to those who register (fee, 5s.), but—as the papers, together with a report of the discussion, will subsequently be published (cloth-bound) as Institute of Metals Monograph No. 13: "Properties of Metallic Surfaces"—the Council particularly requests that those who cannot attend the meeting shall *not* apply for advance copies of the papers, which are printed solely to stimulate discussion and will be strictly limited in number.

1953 Annual General Meeting

The next Annual General Meeting of the Institute will be held in London from Monday, 23 March to Thursday, 26 March 1953, inclusive. The meeting will be organized on lines similar to those of the 1952 Annual General Meeting. In connection with the meeting, there will be an all-day Symposium on "The Control of Quality in the Production of Wrought Non-Ferrous Metals. I.—Melting and Casting", which will be the first of a series of three related annual symposia.

Students' Essay Prize Competition, 1952

A Students' Essay Prize for 1952 has been awarded by the Council of the Institute of Metals to Mr. JOHN C. WRIGHT (Student Member), Laboratory Assistant, Development and Research Department, The Mond Nickel Co., Ltd., Birmingham, for an essay on "The Metallographic Investigation of Failed High-Temperature Components". The prize of twenty guineas has been given in the form of ten guineas in money and ten guineas in books selected by the prize-winner.

The essay has been recommended for publication, and will be printed in the next issue of the *Bulletin*.

Students' Essay Prize Competition, 1953

The Council of the Institute will present two prizes of twenty guineas each for the best essays submitted in accordance with the regulations set out below. Each prize will be in the form of ten guineas in money and ten guineas in scientific, technical, or other appropriate types of books, to be selected by the prizewinner. If of sufficient merit, a prize-winning essay may be published in the Institute's *Bulletin* or selected for reading before a Local Section.

REGULATIONS

1. *Eligibility*.—The competition is open to all Student Members of the Institute, and to all Associate Members of Local Sections who are eligible for Student Membership of the Institute, provided that both are within the normal age limits for Student Membership, viz. 17 to 25 years. A prize-winner will be ineligible to compete in the competition in the year subsequent to that in which he or she submitted a winning essay.

2. *Language*.—Essays must be submitted in English.

3. *Length*.—Essays should be 2500–3500 words long and must not exceed 3500 words. They must be submitted in typewritten form with double-line spacing.

4. *Subject*.—The choice of subject is left to the competitors, except that subjects relating exclusively to extraction or ferrous metallurgy are ineligible. The subject matter should be logically presented, in good English, and should have a metallurgical content to impress the adjudicators by soundness, exercise of critical faculty, and originality of approach. No prize will be awarded if the essays do not, in the opinion of the adjudicators, reach the requisite standard.

5. *Method of Submission*.—Each entry must be submitted to The Secretary, The Institute of Metals, 4 Grosvenor Gardens, London, S.W.1, not later than Thursday, 1 January 1953, and must be accompanied by a certificate, signed by the entrant, that the essay itself is entirely his or her own work, that it has not, in the form in which it is sent, been submitted for any other competition, and clearly stating what (if any) drawings, photographs, &c., have been prepared on his or her behalf.

6. *Presentation of Prizes*.—The prizewinners will be invited to be the guests of the Council at a luncheon to be held in London in conjunction with the Annual General Meeting in March, 1953. They will then receive their prizes from the President, when he presents the Medals awarded by the Institute.

Copper Pass Awards Adjudicating Committee

Mr. CHRISTOPHER SMITH and Mr. W. J. THOMAS have been appointed as the representatives of the Institute on the Copper Pass Awards Adjudicating Committee, in succession to Mr. T. M. Herbert and Professor H. O'Neill.

Mond Nickel Fellowships Committee

Mr. E. H. JONES has been appointed to be the representative of the Institute on the Mond Nickel Fellowships Committee, in succession to Mr. W. A. C. Newman.

Election of Council for 1953-54

In accordance with the Articles of Association, the following are due to retire from the Council at the 1953 Annual General Meeting:

President:

C. J. SMITHELLS, M.C., D.Sc., F.I.M.

Past-President:

Sir ARTHUR SMOUT, J.P., F.R.I.C., M.I.M.M., F.I.M.

Vice-Presidents:

Professor H. O'NEILL, D.Sc., M.Met., F.I.M.
Professor F. C. THOMPSON, D.Met., M.Sc., F.I.M.

Ordinary Members of Council:

E. A. BOLTON, M.Sc., F.I.M.
C. H. DAVY, M.I.Mech.E.
Professor A. G. QUARRELL, D.Sc., Ph.D., A.R.C.S.,
F.Inst.P., F.I.M.
Professor G. V. RAYNOR, M.A., D.Phil., D.Sc., F.R.I.C.,
F.Inst.P., A.I.M.

Under Article 19, Dr. C. J. SMITHELLS will fill the vacancy on the Council as Past-President.

In accordance with Article 22, the Council nominates the following members to fill the other vacancies:

As President:

Professor F. C. THOMPSON, D.Met., M.Sc., F.I.M., Professor of Metallurgy, University of Manchester.

As Vice-Presidents:

Major C. J. P. BALL, D.S.O., M.C., F.R.Ac.S., Chairman, Magnesium Elektron, Ltd., and Director, Sterling Metals, Ltd.
Professor G. V. RAYNOR, M.A., D.Phil., D.Sc., F.R.I.C., F.Inst.P., A.I.M., Professor of Metal Physics, University of Birmingham.

As Ordinary Members of Council:

Mr. W. A. BAKER, B.Sc., F.I.M., Research Manager, British Non-Ferrous Metals Research Association, London.

Mr. J. C. COLQUHOUN, M.B.E., Chairman and Managing Director, The Manganese Bronze and Brass Co., Ltd., Ipswich and Birkenhead; Chairman, Lightalloys, Ltd., London.

Mr. E. R. GADD, F.I.M., Chief Metallurgist, The Bristol Aeroplane Co., Ltd., Engine Division, Filton, Bristol.

The Hon. JOHN GRIMSTON, M.P., Director and General Manager, Enfield Rolling Mills, Ltd., Brimsdown, Enfield, and Director, Enfield Copper Refining Co., Ltd.; Enfield Rolling Mills (Aluminium), Ltd.; and Enfield Zinc Products, Ltd.

Members are reminded that, in accordance with Article 22, any ten members may also at, or before, the business part of the Autumn General Meeting (15-18 September 1952), nominate in writing, with the written consent to act if elected of the person nominated, any duly qualified person other than one of those nominated by the Council to fill any vacancy on the Council, but each such nominator is debarred from nominating any other person for the same election. If two or more persons are nominated for any honorary office they (or such of them as are not Ordinary Members of Council who are not retiring at the next Annual General Meeting) will be deemed to have been nominated also for any vacancies among the Ordinary Members of Council. No person is eligible to fill any vacancy at such Annual General Meeting unless he has consented in writing to be nominated and has been nominated or deemed to be nominated for the same in compliance with this Article.

Senior Vice-President, 1953-54

The Council has elected Dr. S. F. DOREY, C.B.E., M.I.C.E., M.I.Mech.E., F.R.S., Chief Engineer Surveyor, Lloyd's Register of Shipping, London, to serve as Senior Vice-President for 1953-54, and he will be their nominee for the Presidency in 1954-55.

"Atomic Theory for Students of Metallurgy"

A new edition of Institute of Metals Monograph No. 3, "Atomic Theory for Students of Metallurgy", by Dr. W. Hume-Rothery, O.B.E., F.R.S., has just been published.

This well-known book was originally written for the honours student in metallurgy, though it has also been of great value to students in chemistry and physics. The original edition has, with only minor alterations, been reprinted twice, and more than 8000 copies have been sold. In the present revised second edition, most of the original text has been left unchanged, but substantial alterations and additions have been made to Part VI—Electrons, Atoms, Metals, and Alloys, and the chapter on Transition Elements has been rewritten; additions have also been made to the section dealing with Brillouin Zones, some mistakes have been corrected, and throughout the book minor alterations have been made to bring the subject matter up to date. The length of the book has been increased by 36 pages.

PERSONALITIES

Copies may be obtained from the Institute or through any bookseller, price 21s. (\$3.50), post free. Members are entitled to purchase one copy at 10s. 6d. (\$2.00), post free.

Election of Members

The following 21 Ordinary Members, 1 Junior Member, and 10 Student Members were elected on 30 June 1952:

As Ordinary Members

- ARMSTRONG, Richard Giles, Manager, Winget-Synchro Ltd., Rochester, Kent.
- COLLINS, Robert Dorrell, B.Sc., Physicist, British Iron and Steel Research Association, 140 Battersea Park Road, London, S.W.11.
- EARDLEY, Edward Sidney William, Technical Director, Rolling Mill Equipment Division, The Incandescent Heat Co., Ltd., Cornwall Road, Smethwick, Birmingham 40.
- GEHM, Heinz, Dr.rer.pol., Chairman, Deutsche Edelstahlwerke A.G., Krefeld, Düsseldorf, Germany.
- GRUHL, Wolfgang, Dr.Ing., Privatdozent für Metallkunde, Institut für Metallhüttenkunde und Elektrometallurgie, Aachen, Germany.
- HENRI, Maurice, Ing. Civil des Mines, Directeur Technique, Compagnie Générale d'Electrolyse du Palais, Le Palais sur Vienne (Haute Vienne), France.
- JENNINGS, Peter Hardy, B.Sc., Ph.D., Visiting Lecturer in Non-Ferrous Metallurgy, North Staffordshire Technical College, Stoke-on-Trent.
- JUNGHANS, Siegfried, Dr.Ing.e.H., Proprietor, Siegfried Junghans and of Zusatzseisen G.m.b.H., Schorndorf (Württ.), Germany.
- KAUFFMANN, René, Directeur Général, Société pour le Forgeage et l'Estampage des Métaux Légers (FORGEAL), 23 rue Balzac, Paris 8e, France.
- MCQUEEN, Stanley S., B.Sc., Assistant Metallurgist, Rolls-Royce, Ltd., Hillington Estate, Glasgow, S.W.2.
- MIEKK-OJA, H. M., Sc.D., Acting Professor of Physical Metallurgy, Suomen Teknillinen Korkeakoulu (Institute of Technology of Finland), Helsinki, Finland.
- MOSSOUX, Roger, Ing. Civil des Mines, Ingénieur en Chef et Chef de Service des Laboratoires, Fabrique Nationale d'Armes de Guerre, Herstal-lez-Liège, Belgium.
- MOUNTFORD, Norman Duncan Gerard, M.Sc., A.I.M., Development Superintendent, Sheet Metal Section, Rolls-Royce, Ltd., Mountsorrel, Leics.
- PHILLIPS, James Milner, Managing Director, Motor Panels (Coventry), Ltd., Holbrook Lane, Coventry.
- RAJAN, Coimbatore Subramanyam, B.Sc., L.I.M., Charge-man, Ordnance Factory, Ambarnath, India.
- RENOUARD, Martial, Ing. Civil des Mines, Chef du Laboratoire de Recherches, Usine de Couzon, Compagnie Générale du Duralumin et du Cuivre (CEGEDUR), Rive-de-Gier (Loire), France.
- ROBERTS, E. A. O'Donnell, M.Sc., Chief Development Engineer, Mullard Radio Valve Co., Ltd., Mitcham Junction, Surrey.
- ROSS, Robert B., Metallurgist, Rolls-Royce, Ltd., Hillington Estate, Glasgow, S.W.2.
- SHARP, B., Works Director, The Brooke Tool Manufacturing Co., Ltd., Warwick Road, Greet, Birmingham.
- STORDY, John J., B.Sc., Director, Stordy Engineering, Ltd., Cumbria House, 85 Goldthorn Hill, Wolverhampton, Staffs.

WILLEY, Lowell A., Met.E., Research Metallurgist, Physical Metallurgy Division, Research Laboratories, Aluminum Company of America, Box 772, New Kensington, Pa., U.S.A.

As Junior Member

BARNES, Robert Sandford, B.Sc., Scientific Officer, Atomic Energy Research Establishment, Harwell, Didcot, Berks.

As Student Members

- BENNETT, Beresford Oswald, Assistant Metallurgical Chemist, Riley, Harbord and Law, Abbey Orchard Street, London, S.W.1.
- CHESTER, Juan Stanhope, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- EVANS, Gerald James, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- FENOULHET, Brian Louis, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- GARDNER, William Arnold, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- GILBERT, Lawrence Roy, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- MACKEN, Philip John, Student of Metallurgy, Royal School of Mines, London, S.W.7.
- THURGATE, John Campbell, Student of Metallurgy, Cambridge University.
- TODD, Anthony G., Student of Metallurgy, The University, Manchester.
- WOOD, Geoffrey Clifford, Student of Metallurgy, Royal School of Mines, London, S.W.7.

PERSONALITIES

Professor H. W. Swift

(Autumn Lecturer 1952)

Herbert Walker Swift was educated at Christ's Hospital and at St. John's College, Cambridge, of which he was a Scholar. His course at Cambridge was interrupted by war service from 1915 to 1919, during which period he attained the rank of captain, was wounded, and was mentioned in despatches.

He was awarded First-Class Honours in the Mechanical Sciences Tripos in 1920, and subsequently spent a period as Engineer to a firm of textile manufacturers before taking up a career on the academic side of mechanical engineering.

After a period as Assistant Lecturer at the University of Leeds, where he came under the inspiring influence of the late Professor John Goodman, he was appointed Head of the Department of Mechanical Engineering at the Bradford Technical College, in succession to the late Professor G. F. Charnock. During his tenure of this post, from 1926 to 1936, he carried out research on a number of subjects in the field of mechanical science, dealing more particularly with hydraulic flow, mechanical properties of metals, mechanical power transmission, and journal lubrication. For various sections of this work he was awarded the degree of D.Sc. by the University of London, the Thomas Hawksley Medal of the Institution of Mechanical Engineers, and the Diploma of the Institute of British Foundrymen.

In 1936 he was appointed to succeed Professor F. C. Lea as Professor of Engineering in the University of Sheffield,

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the position which he still holds. He is responsible for the three Departments of Mechanical, Civil, and Electrical Engineering, with a Senior Lecturer in charge of each. He was Dean of the Faculty of Engineering from 1936 to 1945.

Professor Swift was Chairman of the Yorkshire Branch of the Institution of Mechanical Engineers in 1936, and was elected a Member of Council in 1946. He was appointed a member of the Mechanical Engineering Research Board on its formation in 1948, and Chairman of its Metal Forming and Machine Shaping Committee. While President of the Sheffield Society of Engineers and Metallurgists in 1950-51, he was an Honorary Member of Council of the Iron and Steel Institute.

In the course of his work in Sheffield, Professor Swift has developed programmes of research in association with several industrial research organizations and has published numerous papers and reports on problems connected with the plastic properties and deformation of metals, particularly the deep drawing of sheet metal, applications of the theory of elasticity, and journal-bearing lubrication. A programme of research on the cold extrusion of metals has recently been completed



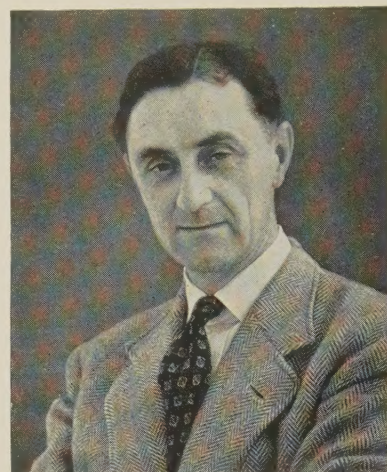
for the Department of Scientific and Industrial Research, and work is still in hand under the aegis of a Joint Committee sponsored mainly by the British Iron and Steel Research Association, on a range of programmes associated with the plastic working of sheet metal. The laboratory equipment which has been developed in the University of Sheffield in connection with these programmes is possibly the best and most complete in existence.

C. E. Ransley

(Chairman of the London Local Section)

Charles Eric Ransley was born in London in 1910 and educated at Wembley County School. On leaving school he joined the Research Laboratories of The General Electric Co., Ltd., as a student-assistant, and graduated in chemistry at London University in 1932. He took an M.Sc. degree in 1936, and gained a Ph.D. in 1940 for his work in the field of gas-metal reactions. As a member of the metallurgical staff of the G.E.C. Laboratories, he was engaged in research on

various problems connected with the manufacture of lamps and thermionic valves, but during the period 1940-1945 he worked mainly on the development of special devices for radar applications. In 1945, he took up his present position with The British Aluminium Co., Ltd., at their then newly-



established Laboratories at Gerrards Cross, Bucks, where he is in charge of a group studying various aspects of the casting and fabrication of aluminium and its alloys.

Dr. Ransley has published a number of papers on metallurgical subjects in the *Journal* of the Institute of Metals and elsewhere, and serves on several committees concerned with various aspects of metallurgical research.

K. M. Spring

(Chairman of the South Wales Local Section)

Kenneth Michael Spring was born at Swansea in 1910, and educated at Glanmor Secondary School, and later at the Swansea Technical College.



In 1926 he joined the firm of D. Pascoe Clarke and Sons, tinplate exporters, as a junior clerk; he left in 1927 to take the post of Junior Assistant in the Chemical Laboratory of British Copper Manufacturers, Ltd., which later became a subsidiary company of Imperial Chemical Industries, Ltd.

OBITUARY

At Landore, from 1930 to 1938, he gained a wide experience in the physical-testing laboratories, copper refineries, brass foundry, copper and brass rolling mills, and inspection departments.

From 1938 to 1942, Mr. Spring was Assistant to the Production Manager and later, until 1947, was Personal Assistant to the Works' Manager. In 1947 he was appointed Manager of an experimental brass sand-casting department, and in 1950 rejoined the staff of the technical section, undertaking metallurgical control of the casting and rolling of special alloys.

He was elected a member of the Institute in 1934, and was Honorary Treasurer of the Swansea (later South Wales) Local Section from 1936 until 1948, when he was elected Honorary Secretary of the Section. In 1947 Mr. Spring was elected an Associate of the Institution of Metallurgists.

H. H. Symonds

(Chairman of the Birmingham Local Section)

Hubert Henry Symonds was born in 1906 and educated at Bablake School, Coventry, and Coventry Technical College. After a period in the laboratory of the Coventry Chain Co., he joined, in 1926, the British Piston Ring Co., Ltd., as Chemist and Metallurgist. In 1932 he became Electrometallurgist and Chemist in charge of the laboratory at the Coventry Chromium Plating Co., and from 1935 to 1941 he was Assistant Chief Chemist and Metallurgist to the Standard Motor Co., Ltd. Mr. Symonds was then appointed Senior Metallurgist in charge of the works metal-



lurgical division of E.M.I., Ltd., Hayes, Middlesex. Subsequently he was Scientist-in-Charge of the Midland Laboratory Guild, Birmingham (1945-51), acting as consultant to a large number of foundries in the Midlands. In February 1951 he took up his present post as Foundry Manager and Technical Advisor to H. B. Barnard and Sons, Ltd., Dudley Port.

Mr. Symonds is a Fellow of the Institution of Metallurgists, a Member of the Institute of British Foundrymen, a Member of the Metal Finishing Association, and a Member of the Technical Committee of the Bronze and Brass Ingot Manufacturers' Association. He joined the Institute of Metals in 1944 and served as Honorary Treasurer and later as Vice-

Chairman of the Birmingham Local Section before being elected Chairman of the Section for 1952-53. He is also a Member of Council of the Birmingham Metallurgical Society.

OBITUARY

Colonel W. C. Devereux

It is with great regret that we record the sudden death, on 21 June, of Colonel W. C. Devereux, C.B.E., F.R.Ac.S., for many years an outstanding figure in the light-alloy industry.

Wallace Charles Devereux was born in 1893 and educated at King Edward's Grammar School, Aston. After a period



as a pupil of Louis Wirtz, consulting engineer and metallurgist, he joined E. G. Wrigley and Co., Ltd., of Birmingham. On the outbreak of the First World War he served with the King's Royal Rifles, but subsequently he returned to industry and in 1917 became Superintendent of National Aircraft Factory No. 1.

After the war he was for a time Works Manager to Peter Hooker, Ltd., Walthamstow, and then in 1927 he founded High Duty Alloys, Ltd., with the object of developing and producing commercially the high-strength light alloys which he foresaw would be required by the aircraft industry. In achieving this purpose he was highly successful, and at the outbreak of the Second World War every R.A.F. aircraft used forged aluminium-alloy pistons. Tribute was paid by the Air Minister in 1939 to the overwhelming importance of the technical developments and facilities for production that Colonel Devereux had built up.

His experience in the field of aeronautical engineering proved invaluable in the late war: from 1939 to 1941 he served as Director of Light Alloy Forgings in the Ministry of Aircraft Production and then he was appointed Controller of American Aircraft Supplies. In this capacity he organized the reception, assembly, and repair of American aeroplanes and engines.

During the latter years of the war, Colonel Devereux, despite his other heavy commitments, directed large-scale surveys into the problems of post-war industry, and he published reports dealing with South Wales and with Cumberland, both formerly depressed areas.

In 1945 he founded Almin, Ltd., which, with its associated companies, embraces the whole range of light-alloy production and fabrication, and has been responsible during the last few

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years for some notable applications of light alloys in structural engineering. Colonel Devereux was always a firm believer in the value of research, and after the war he also founded the Fulmer Research Institute, Stoke Poges, for the purpose of carrying out sponsored research for individual companies.

His research activities extended to his farm at Kimble, Bucks, where he carried out experiments on grass drying, &c. Always an enthusiastic farmer, he established the first commercial artificial insemination centre, which was subsequently handed over to the Ministry of Agriculture. He was President of the Buckinghamshire County Show for three years, and was a keen horseman, being a former Master of the Old Berkeley and South Oxfordshire Hunts. He was an Honorary Colonel of a Territorial Army unit of the Royal Engineers. He received the C.B.E. in 1949.

At the time of his death, Colonel Devereux was Managing Director of Almin, Ltd.; Chairman of International Alloys, Ltd.; Southern Forge, Ltd.; Warwick Production Co., Ltd.; Structural and Mechanical Development Engineers, Ltd., and Fulmer Research Institute, Ltd.; and a Director of Renfrew Foundries, Ltd., and other Companies.

As a result of his work on aluminium alloys, Colonel Devereux became prominent in the aircraft industry, and he was a leading member of the Royal Aeronautical Society (of which he was a Fellow and former Member of Council) and Vice-Chairman of the Royal Aero Club. He also took an active interest in the affairs of the Institute of Metals, which he joined in 1928 and on whose Council he served from 1939 to 1943. The Institute was represented at his funeral by Major P. L. Teed (Member of Council) and at a Memorial Service in London by the President.

PERSONAL NOTES

DR. D. V. ATTERTON has left Cambridge University to take up the newly established post of Research and Development Manager to Foundry Services, Ltd., Birmingham.

MR. D. BINDLEY has left K. and L. Steel Founders, Ltd., and joined The de Havilland Aircraft Co., Ltd., Christchurch, Hants, as Assistant Metallurgist.

MR. J. W. BROMMERT has left the Cavendish Laboratory, Cambridge, and returned to the University of the Witwatersrand, Johannesburg, South Africa.

MR. D. K. COUTTS has returned to the United Kingdom from India.

MR. A. CROSBY has been appointed Deputy Chief Metallurgist at the Royal Ordnance Factory, Patricroft, Eccles, near Manchester.

DR. R. T. FOWLER has left the British Iron and Steel Research Association to become Lecturer in Chemical Engineering at the University of Sydney, Australia.

MR. G. B. GARNHAM has been elected President of the National Association of Non-Ferrous Scrap Metal Merchants.

MR. H. G. HERRINGTON has been appointed Managing Director of High Duty Alloys, Ltd., Slough.

DR. W. G. HISCOCK has been appointed a director of the Consolidated Zinc Corporation, Ltd.

MR. K. B. JOHNSTON is now at the Aeronautical Inspection Directorate, Harefield, Middlesex.

MR. C. F. NAGEL, Jr., has been appointed a Vice-President of the Aluminum Company of America.

MR. J. W. POKORNY has taken up a post in the Lamp Works of The British Thomson-Houston Co., Ltd., Rugby.

MR. J. R. STEVENS has taken up an appointment with the Iraq Government as Metallurgist in the Directorate of Mines, Baghdad.

MR. R. CAMPBELL WILLIAMS has resigned his position as Technical Manager to New Metals and Chemicals, Ltd., in order to set up in private practice as a consultant and technical adviser in rare metals. His address is 16 Robins Court, Kings Avenue, London, S.W.4.

Death

The Editor regrets to announce the death of:

MR. ERIC HOWARD MUNNIK, Engineer Technician, Rhodesian Iron and Steel Commission, Redcliffe, S. Rhodesia, on 22 May 1952.

LETTERS TO THE EDITOR

Intercrystalline Cracking of Metals

The mode of initiation of cracks internally in metals—whether under prolonged application of internal or external stress, under fatigue conditions, or even in a “static” tensile test—has always presented a difficulty to the writer.

The suggestion is now made that cracks are caused by the aggregation of vacant lattice sites. Recent work on the diffusion of metals has indicated the possibility of the creation of vacant sites in metals and alloys by reason of the greater rate of diffusion of one kind of atom as compared with another. Further, it has been suggested that the porosity formed in such cases is due to the coalescence of these vacant sites.

The view is generally held, and it seems quite reasonable, that in crystals even of an annealed metal many vacant lattice sites exist. It is now suggested that under the joint action of stress and thermal movement of the atoms these vacant sites can migrate. In the higher-melting-point metals this may need an elevation of temperature.

If it is postulated (a) that these empty spaces migrate preferentially in the direction of a tensile stress, and (b) that grain boundaries across which a tensile stress is maintained can more readily accommodate vacant sites, the latter would accumulate in boundaries which lie at right angles to the stress direction.

The end effect is illustrated in Figs. 1 and 2. Fig. 1 shows 1000 balls arranged on two orientations with 18 vacant sites and Fig. 2 shows the same balls arranged so that 10 of the vacant sites are concentrated at the change of orientation.

When a sufficient number of vacant sites have accumulated in any boundary, conditions for the breaking of the cohesive bonds will have occurred, i.e. an intercrystalline crack will have started which will open out under the continued stress.

The conditions for intercrystalline cracking would then appear to be: (a) increased temperature and (b) decreased rate of strain. The former of these conditions permits mobility of the vacant sites, and the latter creates time for their migration. It will be recognized that these are precisely the conditions which lead to intercrystalline cracking by creep. The term migration is used rather than diffusion because a vacant site, having no prescribed shape, can reappear anywhere in the lattice when it has been displaced by an atom occupying it. Hence the migration would, in general, be more rapid than diffusion.

A simple calculation shows that this mechanism for the formation of intercrystalline cracks does not make excessive demands on the number of vacant sites available. Consider a crystal of the order of 0.1 mm. linear dimension. There will be approximately 3×10^5 rows of atoms in each axial direction. If each row contained two vacant sites, i.e. one vacant site in 150,000, there would be sufficient to separate completely by two atomic distances an area of boundary surface (0.1 mm.)². As soon as an area of boundary surface has lost its cohesion, i.e. a crack has started, the increased stress along the periphery of the area will aid the propagation of the crack.

This hypothesis would then explain the initiation of intercrystalline cracking under those creep conditions which are known to cause it. It would equally explain the initiation of the tertiary stage of creep, whether in tension or compression. It is known that the creep-resistance of metals can be increased by strengthening the crystals by alloying. It is now suggested that the prevention of migration of vacant sites, or the reduc-

were made from microscopic observations (optical), where the cross-slip lines appeared as well-defined traces over considerable lattice spacings (as in Fig. 1, for example). Recent work on pile-irradiated copper single crystals^{6, 7} has confirmed the (111) as the cross-slip plane where these planes have been determined from their relatively large traces on the surface.

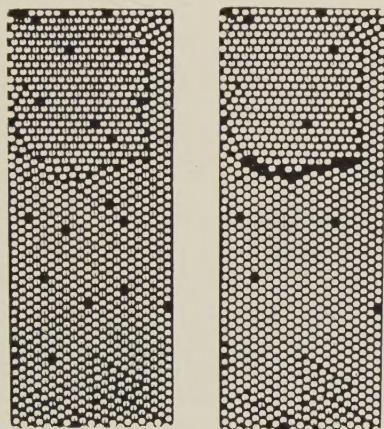


FIG. 1.

FIG. 2.

tion of their number, would lead to reduction in the incidence of intercrystalline cracking.

From work done in this laboratory, it is evident that some solutes inhibit cracking whereas others accelerate it. For example, thallium reduces, while tellurium greatly increases, the liability of lead to intercrystalline cracking. A further point is that the theory suggests why short-time creep tests may not give the same answer as long-time tests.

These thoughts are put down in the hope of stimulating discussion and giving new lines for experiment in this important field.

J. NEILL GREENWOOD
Research Professor of Metallurgy.

*The Baillieu Laboratory,
University of Melbourne,
Australia.*

Cross-Slip in Aluminium and α -Brass

In the past four years there have been a number of investigations in which observations on primary and cross-slip in axially extended single crystals of aluminium and α -brass have been reported.¹⁻⁵ The original reports on the existence of cross-slip in α -brass^{4, 5} defined the cross-slip plane as (111) where the primary plane was (111), the direction of glide on both planes being $[\bar{1}01]$. Many determinations of these planes

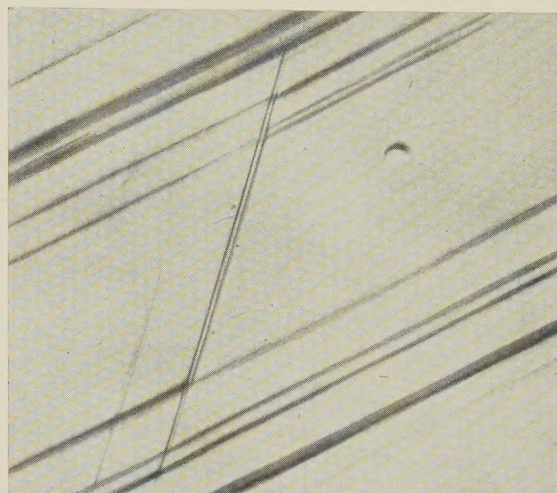


FIG. 1.—Cross-Slip in an Axially Extended α -Brass Single Crystal. Stress axis vertical. Taken at a position which was perpendicular to the plane containing the slip direction and the stress axis. $\times 1000$.

The observations of "cross-slip" in aluminium have presented a slightly different picture of these traces.^{1, 2, 3} Here, their character (cf. Fig. 2), is suggestive of a region in which considerable distortion exists where the primary lines end.

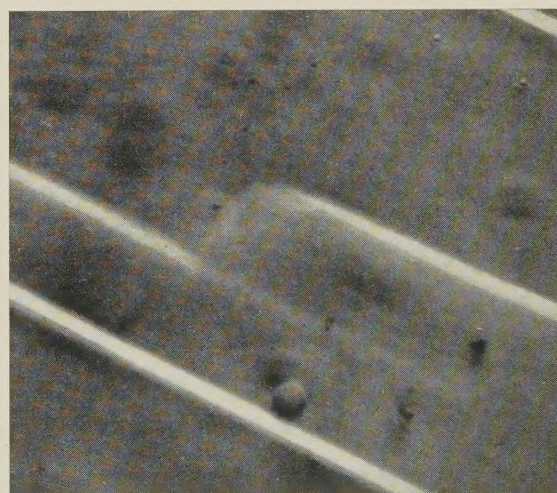


FIG. 2.—Overlap of Primary Slip Lines in an Axially Extended Aluminium Single Crystal, at a Position Very Close to the Head of the Ellipse (after Chen and Pond³). $\times 2000$.

It certainly cannot be argued at the present time whether the "non-crystallographic appearing traces" are unresolved small steps of alternate slipping on (111) and (111) planes in a common $[\bar{1}01]$ direction or are in reality non-crystallographic slip. Trotter² states that "primary and primary cross-slip are defined as slip in a common direction on two planes which

may or may not be of the same crystallographic form". It seems that although this may be so in the case of aluminium, cross-slip in α -brass single crystals is certainly different. Perhaps a more descriptive term describing this phenomenon in aluminium would be "overlap".

ROBERT MADDIN

Associate Professor of Metallurgy.

The Johns Hopkins University,
Baltimore 18, Md., U.S.A.

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Low-Stress Torsional Creep Properties of Pure Aluminium

In a letter to the Editor (*Bulletin*, 1952, **1**, (9), 76), Dr. Betteridge has outlined the results of some torsional creep tests on super-purity aluminium rods of various grain-sizes, produced by annealing at temperatures between 300° and 600° C. after cold working with 95% reduction in cross-sectional area. The results indicated that prior creep strain decreased progressively with increasing annealing temperature and, except in one instance, with increasing grain-size. In addition, it was established that no creep occurred in a single crystal. Assuming that creep was a result of viscous flow at grain boundaries and that grain-boundary viscosity remained constant, the results could not be explained solely by variations in grain-size, and it was therefore concluded that the effective viscosity depended on previous cold working and annealing.

It is possible to interpret these interesting observations on the assumption that there are differences in preferred orientation in the annealed rods before testing. Although we have no information on variations in recrystallization texture with annealing temperature in rolled or drawn rods of super-purity aluminium, results we have obtained with rolled strip indicated that, with the same reduction in thickness (of the order of 90 or 95%), the proportion of (100)[001] texture increased as the annealing temperature was increased. In recrystallized rolled or drawn aluminium rods a $\langle 111 \rangle$ fibre is dominant, but published information¹ indicates that the precise texture depends both on annealing temperature and purity.

Two possible explanations of the decrease in creep strain with increasing annealing temperature are therefore suggested. First, assuming creep takes place by grain-boundary flow, the behaviour may be associated with increasing proportions of a particular single texture, the specimen becoming in nature more and more like a single crystal. Even with a complete single texture there would, of course, be grain boundaries, but it is reasonable to suppose that the viscosity of such boundaries, between crystals differing only slightly in orientation, would be higher than that of boundaries between grains differing greatly in orientation.

Alternatively, decreasing creep strain may be associated with the progressive elimination of a $\langle 111 \rangle$ fibre texture with increasing annealing temperature, deformation in this case being mainly within the grains. This suggestion arises from recent work by Jillson,² who demonstrated that the ease of twisting a single crystal of zinc with its basal plane perpendicular to the rod axis was "startling", and the mechanism of deformation appeared to be a simple rotation of basal planes upon each other without regard for the crystallographic requirements of slip. It is significant in this connection that Heidenreich and Shockley³ reported rotations as well as translations of slip planes upon each other when single crystals of aluminium were deformed in tension.

In order to ascertain whether either of the two possibilities has any foundation, may we suggest to Dr. Betteridge that he examines his polycrystalline rods for preferred orientation and carries out, if possible, a creep test on a single crystal having a $\langle 111 \rangle$ torsion axis.

T. LL. RICHARDS

D. E. YEOMANS.

Metals Division,
Imperial Chemical Industries, Ltd.,
Birmingham 6.

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In a recent letter¹ it is reported that low-stress torsional creep tests on pure aluminium specimens of differing grain-size provide results which cannot be simply reconciled with the Kê mechanism,² and it is suggested that account must be taken of the effects of the different annealing treatments. The fact that the boundary can exhibit viscous properties is clearly not in question: there is direct evidence for this from bicrystal tests,³ Kê's experiments⁴ support it, and it can be successfully reconciled with the permanent flow in a two-mechanism model such as that proposed by Andrade.⁵ The question which presents itself is whether the discrepancy arises from different boundary-dislocation properties, due to the different treatments, or whether it arises from a misinterpretation of the grain-boundary mechanism.

The purpose of this note is to point out that the results reported are not irreconcilable with the behaviour of fairly simple models.

(a) The Single-Mechanism Model

We assume in this that the creep curve results from a single self-hardening process wholly within the grain-boundary regions, the interior of the grains remaining unaffected. If the behaviour of a single intercrystalline boundary can be expressed by a formula of the form $\epsilon = \alpha \cdot f(t)$, where ϵ is the creep strain, $f(t)$ a function of the time, and α some parameter, then, in metallurgically identical aggregates differing only in their grain-size, α should be proportional to the total grain-boundary area, or inversely proportional to d , the mean grain diameter. This hypothesis does not fit the result of Betteridge, as examination will reveal. If, however, the creep curves are replotted as in Fig. 1, which shows $\log \epsilon$ against $\log t$, then a family of fairly good straight lines is obtained. Expressing the general relationship as $\epsilon = \beta t^m$,

we find m has the values shown, all remarkably close to $\frac{1}{3}$, except for the curve which corresponds to a grain diameter of 0.64 mm., and this can be picked out from the Betteridge

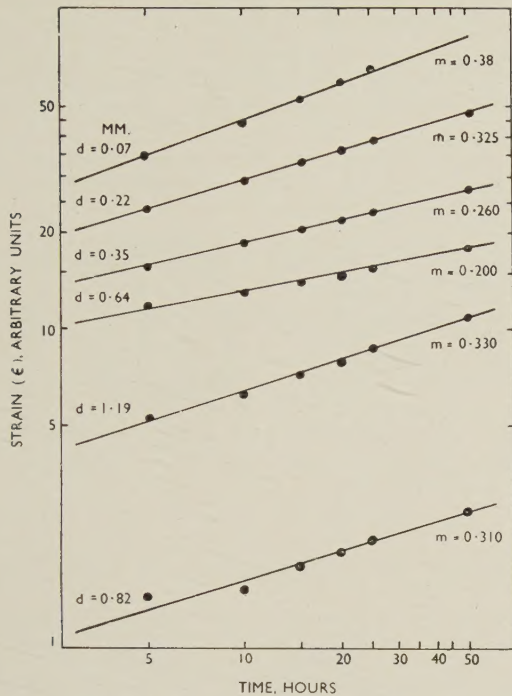


FIG. 1.—The Relationship $\epsilon = \beta t^m$.

curves as being of a somewhat different character. The fact that the curves are very close to cubic parabolas is of secondary interest here, and not immediately relevant to

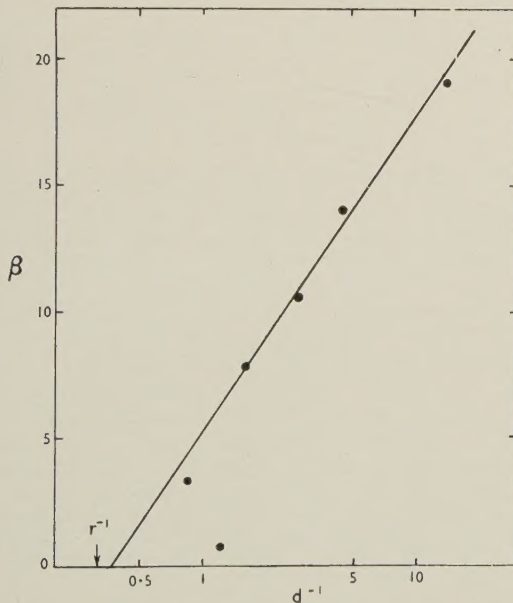


FIG. 2.— β (in arbitrary units) plotted against $\log(d^{-1})$.

the point in question. The strain scale is arbitrary, being in millimetres as measured from the published curves. The values of β can be simply derived from the ϵ -intercepts at

$t = 1$, and these can be shown to vary non-linearly with d^{-1} . As the grain-size diminishes, the experimental value of β is less than that required by considerations of linearity. The mechanism of $K\dot{\epsilon}$, then, may be supposed to hold for large values of d , but, as d approaches some critical size (say the dimension of the substructure), deformation becomes more difficult. A mechanism which involves interaction with the substructure is not difficult to picture physically, although the size of the Wood⁶ cells, for aluminium at these test conditions, appears far too small to influence the results appreciably. Alternatively, we may look for some simple relation between β and d , as demonstrated by Fig. 2. β plotted against $\log(d^{-1})$ provides a good linear relationship, except, in this case, for the value for the specimen of grain diameter 0.82 mm., which is in any case out of sequence in the original results. β tends to zero for a value of d very near to r , the radius of the rod. The exact value is hardly

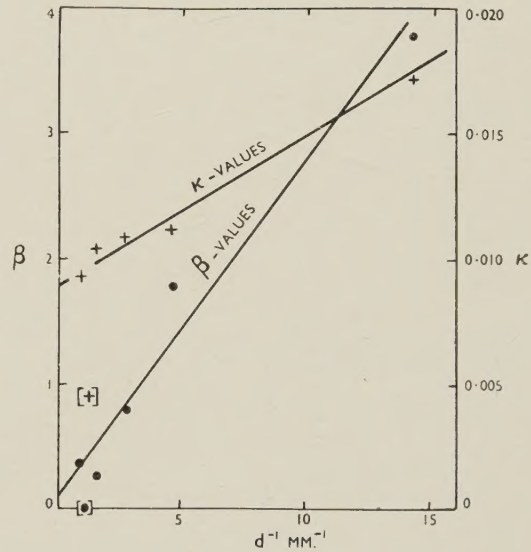


FIG. 3.—The Units of β and κ Satisfy the Relationship $\epsilon = l_0 + \beta t^3 + \kappa t$, where ϵ is measured in the arbitrary units of Fig. 1, t is in hours and d in mm.

significant, but it is clear that the empirical fact that $\beta = 0$ for a single crystal is consistent with such a treatment of the data. On these lines, then, a model must be developed which will exhibit the $\log(d^{-1})$ relationship.

(b) The Two-Mechanism Model

The conventional two-mechanism model in the case of high-stress creep comprises both transient and permanent components, as in the case of the Andrade model, which has been successful in expressing the results of a wide variety of experiments.^{7,10} It has already been suggested⁸ that there is little transient flow (β -flow) in the low-stress case and that deformation occurs almost entirely by permanent, or κ , flow. This type of (linear) flow does not correspond with the observations in the very low-stress regions under discussion here. The possibility remains that two processes are in operation in the low-stress case, similar in nature, if not in origin, to those which characterize high-stress creep. An examination of the Betteridge data has been made from this standpoint, using the modified Andrade equation $l = l_0 + \beta t^3 + \kappa t$. The results are shown in Fig. 3: β and

κ may be said to vary approximately linearly with d^{-1} (i.e. both components are proportional to the amount of grain boundary present), with β tending to zero and κ to a finite value as d increases. If this interpretation were valid, a single crystal should deform by a small linear κ -flow, with no transient β -flow at all. This does not accord with the single-crystal experiments. The disagreement may possibly arise from incorrect formulation of the transient and permanent components. It might also be said here that experiments by the author on the (large) torsional creep of tellurium lead, a material which gave the perfect cubic parabolas already reported⁹ in tension, gave results which were far less consistent than those for the tensile case. In addition, the power of the time was not consistently $\frac{1}{3}$ for all stresses, and, over a certain range of conditions, a well-defined creep limit was exhibited.

Interpretation of torsional creep results is always difficult because of the nature of the stress distribution. It is suggested that a more fruitful experimental approach would be to work in the low-stress range under pure constant shear (as in the Andrade and Jolliffe experiments¹⁰) with specimens of different grain-size. Such results should make possible a more precise interpretation of the processes involved in grain-boundary creep.

A. J. KENNEDY.

*The Davy Faraday Laboratory,
The Royal Institution,
London, W.1.*

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NEWS OF LOCAL SECTIONS AND ASSOCIATED SOCIETIES

Leeds Metallurgical Society

The recent metal shortage has introduced many serious problems in industry, particularly with regard to the use of alternative materials. Although the position is changing now in respect of some base metals, certain strategic metals are likely to be scarce for some time. To enable information to be exchanged, the Leeds Metallurgical Society proposes to hold a Week-End Conference on:

Problems Arising from Metal Scarcities and the Use of Alternative Materials

The Conference will be held at a very attractive venue within two miles of Leeds City Centre, beginning on Friday evening, 5 September, and ending on Sunday afternoon,

7 September. This project has the support of the Metal Economy Committee, Ministry of Supply, and a number of speakers of national standing will be present to initiate and take part in the various discussions.

The cost of meals and sleeping accommodation will be approximately 35s., and there will be a small registration fee. Accommodation for part of the time can be arranged, and meals will be available for those not requiring sleeping accommodation.

All enquiries should be addressed to: Dr. K. J. Irvine, Department of Metallurgy, The University, Leeds, 2.

NEWS OF KINDRED SOCIETIES

Associazione Italiana di Metallurgia

The sixth National Convention of the Associazione will be held in Genoa from 20 to 23 September. In the course of the meeting the second award of the Luigi Losana Gold Medal will be made to Professor John Chipman, President of the American Society for Metals, who will subsequently deliver an address in French.

APPOINTMENTS VACANT

A COMPANY 20 miles west of London requires an assistant chemist for the analysis of copper- and nickel-base alloys, stainless steel. Knowledge of spectrographic analysis an advantage. Salary according to age, qualifications, and experience. Write Box V.248, Willing's, 362 Grays Inn Road, London, W.C.1.

METALLURGIST with University qualifications, required for investigational work on problems associated with the welding of steels, in modern metallurgical laboratory in North London area. Some experience in research or industry essential, and a knowledge of arc welding an advantage. Excellent salary and prospects for suitable applicant. Write Box JIM655, L.P.E., 110 St. Martin's Lane, London, W.C.2.

METALLURGIST with University qualifications, required for development work on light-alloy welding in Metallurgical Research Department in North London area. Preference given to applicant with some industrial experience in light-alloy welding or founding. Salary £600-£850. Write Box JIM656, L.P.E., 110 St. Martin's Lane, London, W.C.2.

NELSON RESEARCH LABORATORIES, English Electric Co., Ltd., Stafford, will shortly have a vacancy for a graduate physicist or metallurgist with some experience of X-ray-diffraction techniques for work in their metallurgical laboratory. Please write, giving full details of qualifications and experience and quoting reference 996, to Central Personnel Services, 24-30 Gillingham Street, London, S.W.1.

POSTGRADUATE AND FINAL-YEAR UNIVERSITY STUDENTS in engineering, metallurgy, and chemistry are invited to send details of their records to the Staff Manager (Ref. GBLC/S/292), Research Laboratories of The General Electric Co., Ltd., Wembley, Middlesex. A number of openings in interesting experimental research will be available during the coming months for men with outstanding ability and qualifications.

THE BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION requires investigators to study various problems in the fabrication and use of non-ferrous materials. Qualified metallurgists, chemists, and physicists are invited to apply in writing giving details of age, qualifications, and experience, to the Secretary, 81-91 Euston Street, London, N.W.1.

Correction

It is regretted that an error occurred in the advertisement by the Fulmer Research Institute which appeared in the June issue of the *Bulletin*. The third post referred to should have read: PHYSICAL CHEMISTS for work in inorganic chemistry (not organic chemistry).